

CLAIMS

What is claimed is:

1. A method of making bonded discs, in particular optical data carriers such as DVD, UDO disc or blueray disc, comprising the steps of:
 - (1) production of two substrates;
 - (2) coating at least one of the substrates with an adhesive;
 - (3) placing the substrates in standby position in a transfer station;
 - (4) grabbing the substrates;
 - (5) transporting the substrates to a joining station;
 - (6) depositing the substrates in the joining station;
 - (7) bonding the substrates;
 - (8) opening the joining station and withdrawing the joined disc;
 - (9) inspecting compliance with quality standards of the disc; and
 - (10) placing the disc on a stack of acceptable discs or on a stack of rejected discs in response to the inspecting step,
wherein the steps (1) to (10) are carried out by handling the substrates in a circular manner for transport along two concentric circular paths of different diameter, thereby defining an inner circle and an outer circle, with one substrate transported on the inner circle and the other substrate transported on the outer circle.
2. The method of claim 1, and further comprising the step of metallizing at least one of the substrates between the steps (1) and (2).

3. The method of claim 1, wherein the disc is transported along one of the inner and outer circles along which the substrates are moved.
4. The method of claim 1, wherein the disc is transported along the inner circle.
5. The method of claim 1, wherein the inner and outer circles define a common center, said substrates being placed in the transfer station behind one another in radial direction, as viewed from the common center, and grabbed in the transfer station simultaneously for transport to the joining station and simultaneously deposited in the joining station.
6. The method of claim 5, wherein the steps (4)-(6) and the transport of the disc is realized by a carousel which sweeps over a circle and has gripper arms provided with gripper elements, wherein at least one gripper arm has two gripper elements arranged behind one another in radial direction for simultaneous removal of the sequentially disposed substrates from the transfer station, wherein the gripper arms are adapted to travel to a neutral position between processing stations, when the joining station is to be opened or closed.

7. The method of claim 1, wherein the joining station has two halves provided for receiving the substrates and configured to unfold to an open position and to fold together into a closed position, wherein the depositing step involves placement of one substrate in one half and placement of the other substrate in the other half of the joining station, with one half of the joining station positioned on the inner circle and the other half of the joining station positioned on the outer circle, when the halves assume the open position.
8. The method of claim 1, and further comprising the step of moving at least one of the substrates and the joined disc to a further processing station situated outside the inner and outer circles.
9. Apparatus for making bonded discs of two substrates, in particular for making optical data carriers such as DVD, UDO disc or blueray disc, comprising:
 - an adhesive application station for coating at least one of the substrates with an adhesive;
 - a plurality of processing stations, disposed downstream of the adhesive application station, for further handling the substrates, said processing stations arranged about a circle and including
 - a transfer station for placing the substrates in a standby position for further processing,
 - at least one joining station for joining and bonding the substrates to

produce a finished disc,
at least one quality inspection station for checking the disc for acceptance or rejection,
a first delivery station for receiving the disc, when the disc is acceptable, and
a second delivery station for receiving the disc, when the disc is unacceptable; and
a central handling system in the form of a carousel which includes a plurality of gripper arms and is constructed to move the gripper arms in horizontal and/or vertical direction into a number of indexing positions, wherein a first type of the gripper arms has two gripper elements arranged behind one another in radial direction so as to enable the gripper elements to sweep over two concentric circles of different diameter, when the gripper arms are moved in circumferential direction.

10. The apparatus of claim 9, wherein the transfer station is adapted to receive the substrates behind one another in radial direction so that the substrates are lined up along a straight line which intersects a rotation axis of the carousel at a right angle.
11. The apparatus of claim 10, wherein the two gripper elements of the first type of gripper arms have a distance from another to allow a simultaneous grabbing of the substrates.

12. The apparatus of claim 9, wherein a second type of the gripper arms include a single gripper element which is arranged on an inner one of the two concentric circles.
13. The apparatus of claim 9, wherein the carousel has a third type of gripper arms constructed for telescopic movement in radial direction.
14. The apparatus of claim 9, and further comprising at least a second said joining station, each of the joining stations including two halves which are provided for receiving the substrates and configured to unfold into an open position and fold together into a closed position, wherein the joining stations are so positioned that their halves extend behind one another, when the halves assume the open position, with one half situated on an inner one of the two concentric circles and the other half situated on an outer one of the two concentric circles.
15. The apparatus of claim 9, wherein the carousel is constructed to halt the first and second gripper arms into indexing positions between the processing stations.

16. The apparatus of claim 9, wherein five of said gripper arms are provided in spaced-apart relationship to define therebetween four angles of each 60° and one angle of 120°.
17. The apparatus of claim 9, wherein the carousel is adapted to move the gripper arms in clockwise direction and in counterclockwise direction into indexing positions of 30°, 60° and 120°.
18. The apparatus of claim 17, wherein six of said processing stations are provided in spaced-apart relationship at an angle of 60° about a circle, with the 30° positions representing idle positions between two processing stations.
19. The apparatus of claim 16, wherein four of the five gripper arms are of a second type of gripper arms with a single gripper element and of a length which is shorter than a length of the first type of gripper arm, wherein the gripper elements of the second type of gripper arms are situated on an inner one of the two concentric circles, wherein one of the gripper elements of the first type of gripper arm is situated on the inner one of the two concentric circles and the other gripper element of the first type of gripper arm is situated on an outer one of the two concentric circles, wherein the bisecting line of the 120° angle lies on a straight line with the first type of gripper arm.

20. The apparatus of claim 9, and further comprising a first linear guide for advancing the substrates to the transfer station, and a second linear guide arranged in parallel relationship to the first linear guide for supply of spacers or uncoated substrates to the central handling system.
21. The apparatus of claim 9, wherein the carousel is constructed to move the gripper arms in horizontal direction and separately thereto in vertical direction.